



In The Clear

The Weather Newsletter For
Interior Central California



Summer 2008 Edition

National Weather Service/Hanford, CA

SJV SKYWARN Spotters

By Bruce Buhler, KD6DRU

Under the leadership of James Brotherton, the "inaugural" meeting of the "NWS San Joaquin Valley Skywarn Spotters" was held. Plans were made to obtain a new HF radio, relocate the multi-band vertical HF antenna, obtain a call sign from the FCC for the station that would include call letters HNX, Hanford NWS's alpha designation, and setup an organizational structure whereby the amateur radio station could be made operational in the event of a pending weather event under the Skywarn guidelines.

With input from Ed Vonderbeck, KA6PNL, and Dan Pruitt, AE6SX, James procured a Kenwood TS-2000 HF radio. With this radio contacts can be made with other NWS locations throughout the country. In December there is an annual Skywarn recognition event where NWS sites with an amateur radio station make contact with each other and amateur radio operators make contact with NWS stations.

The multi-band vertical HF antenna, which is connected to the Kenwood TS-2000, was relocated from within the chain link fence enclosure of the doppler radar dome to a location on the fence along the northern property line about 100 feet to the east. This required pulling new coaxial cable from the radio to the antenna's new location a distance of about 300 feet. Additionally a trench about 80 feet long needed to be dug to the base of the antenna site.

...continued on page 5...

Yosemite Half Dome NetCam Mon Jun 23 06:30:03 2008 Exp: 332
Temperature: 68.0°F (20.0°C) Humidity: 35% Pressure: 29.96 in.



© 2008 Yosemite Association -- www.yosemite.org StarDot NetCam Megapixel

This photo is from the Yosemite National Park Halfdome webcam on June 23. Intense smoke infiltrated much of the Central Valley and adjacent areas due to several ongoing wildfires during late June. High levels of smoke can wreak havoc on air quality and visibility, as well as cause and aggravate certain health conditions.

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Open Letter to Friends of the SJV NWS

By James Brotherton, Warning Coordination Meteorologist

To all of our volunteer SKYWARN spotters and other partners and friends:

Welcome to the Summer 2008 edition of "In The Clear"! I want to emphasize that this is *your* newsletter! Whatever you would like to see discussed or investigated can be done...all you have to do is let us know. To let us know what you would be most interested in reading about, or new ideas for columns, just send an email to w-hnx.webmaster@noaa.gov or call 559-584-3752.

During this time of the year, reports from spotters are still very much appreciated. That said, while summer continues across Central California, this time of year can bring the monsoon flow far north into Central California. We have already seen that demonstrated, unfortunately, in the southern Sierra Nevada,

Tehachapis, and Mojave Desert, where several rounds of significant flash flooding occurred over the past few weeks due to strong monsoonal moisture (please see related article on page 7).

The NWS needs your reports any time of day or night, any time of the year. The effort that you, as our good neighbors, put into the SKYWARN Program, to help your neighbors, is commendable. Your reports have been timely and assisted us tremendously in issuing and verifying our weather warnings.

I'm sure that when you first became a part of our network, you were excited to become an ally of the NWS. We would like to work with each of you to keep that interest. Sometimes our interests wane after a couple of years for whatever reason. The Hanford office wants to rekindle the early flame that you exhibited by offering refresher training to any group that requests it. In addition, please contact us and let us know if you would like to assist in setting up a time and place to offer SKYWARN training for your civic group, club, and neighbors.

Last but not least, special thanks go out to our partners in the media, emergency management, fire and law enforcement agencies that help the NWS to protect life and property from hazardous weather events. Your partnership is extremely valuable to us!

Sincerely,

James Brotherton



Wall cloud associated with a small severe thunderstorm near Visalia along Hwy 198 on January 27, 2008. This storm caused scattered property damage from Tulare northeast to Squaw Valley. Image courtesy of NWS Hanford.



CoCoRaHS



Community Collaborative Rain, Hail and Snow Network

Because.... *"Rain Doesn't Fall the Same on All"*

By Bill Peterson, Hydrometeorological Technician

CoCoRaHS is a non-profit organization of volunteer backyard observers whose purpose is to help "fill in the gaps" where measurable precipitation normally isn't recorded. Folks just like you are relied upon to accurately measure and report your findings on a simple to use form via the internet to the CoCoRaHS web-site. YOUR local National Weather Service will then use this information in its forecasts and post storm reporting.

CoCoRaHS is expected to be starting up in California in the near future, most likely by October of this year. More information about the program can be found by visiting the CoCoRaHS website at: www.cocorahs.org or by contacting Bill Peterson at william.peterson@noaa.gov.

Weather Kiosk Now Online at Hanford's Visitor Center

Have you been to the AMTRAK station lately in Hanford? If so, you should walk down the hallway to the Hanford Visitor's Agency main office and check out our new Weather Kiosk, provided courtesy of the National Weather Service in Hanford, and in partnership with the Hanford Visitor's Agency.

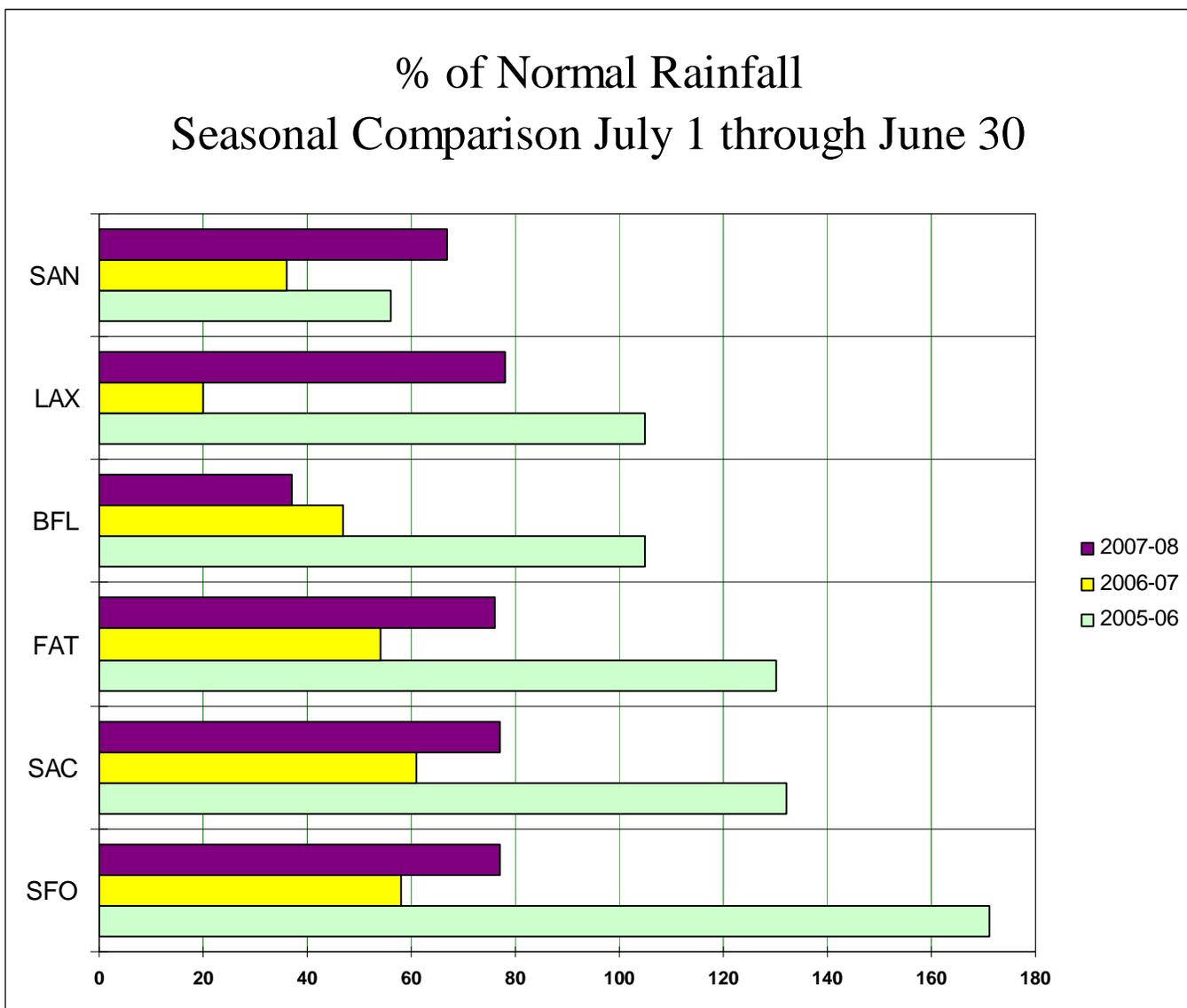
This weather kiosk provides visitors to the city an intuitive collection of weather data, satellite, radar, and live webcams, and forecasts and severe weather information for the immediate area. Next time you are getting ready to catch the train, be sure to check out our new display! Weather displays are also in the works at several other sites across Central California. If you have any comments or questions about the kiosks, please contact us at 559-584-3752.



Comparison of Water Year Rainfall to Normal

By Kevin Durfee, Meteorologist

As you can see from the chart below, this past water year (July 1 – June 30) brought below normal rainfall to many major observation stations across California. However, we do see some improvement compared to the 2006-2007 water year. Keep in mind, long-term dry spells see little or no recovery without near or above normal water seasons. With this in mind conditions across some parts of California, especially the San Joaquin Valley, continue to experience the effects of a dry season. Some municipalities across the valley have experienced water shortages and enforcements of water restrictions, as well as reports of contamination to municipal water supplies.



SJV SKYWARN Spotters...continued

This was no small task since the ground was covered by about 6 inches of rocks and had hard packed dirt and rocks underneath. Dave Whitehead, WA6KSF, and his 7 year old grandson, Raymond, Mike Cowen, KI6IBT, Ed Vonderbeck, KA6PNL, Bart Morrill, KI6KAN, Bruce Buhler, KD6DRU, Mike Enquist, WA7YHX, and Dan Pruitt, AE6SX, volunteered their time and expertise on the antenna relocation project by digging the trench, pulling the coax under the buildings floor, through existing and newly laid underground conduit to the new antenna site, moving the antenna, re-connecting it and refilling the trench. One of the newest amateur operators is James Dudley, KI6PIO, and can be seen in the picture with the antenna at its new location (see picture below). Mr. Dudley was also part of the effort, along with his son Eric, in the trenching project. The new HF setup works great.

The new call sign for the station is WX6HNX. Dan Pruitt, AE6SX, deserves credit for being persistent in pursuing the new call sign. When this call sign is used during radio contacts all parties will be able to identify the station's location as the Hanford NWS office.

Bruce, KD6DRU, is the designated first contact for weather station staff when a weather event is expected. Primarily 2-meter VHF frequencies will be used for Skywarn reports. Most contacts will be made through repeaters located on mountain peaks or high ridges. Those high elevations allow line of site contacts to be made at long distances. So far this year there have been two events where amateur radio operators came to Hanford NWS to operate the Skywarn station. Contacts have been made on 2 meters from Bakersfield to west of Merced.

The San Joaquin Valley Skywarn Spotters executive committee is currently working on a



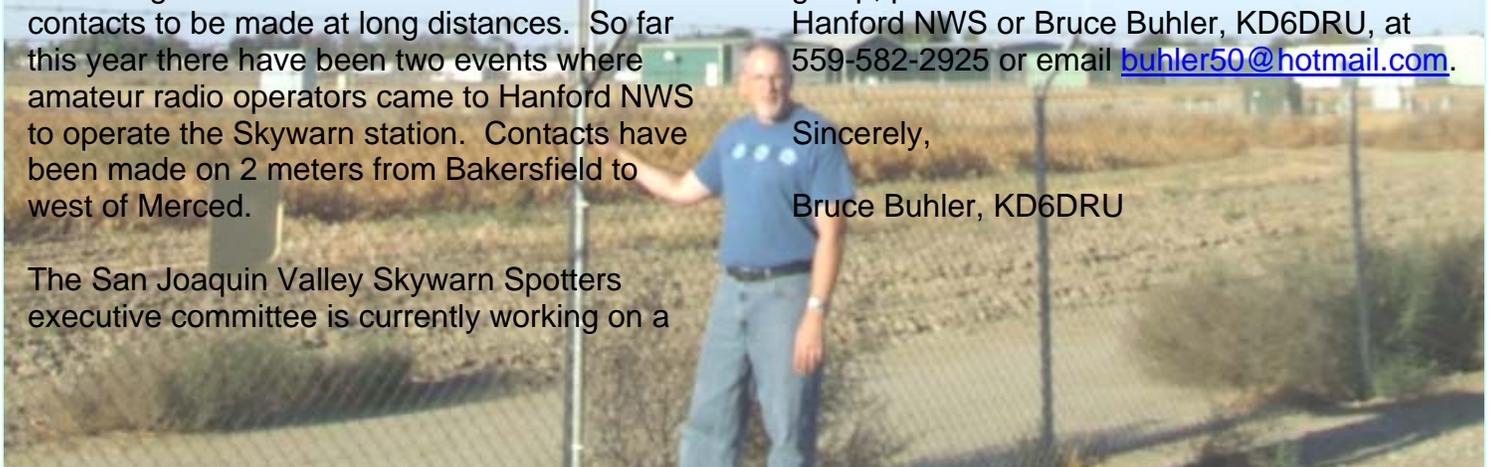
Skywarn spotters operator manual, updating information on the Hanford NWS Skywarn website and developing contacts among the existing ARES organizations and clubs in the Hanford NWS coverage area. Recently Dave Harler, W6DYH, from Reedley joined the group. Over the next several months the committee will meet monthly.

The Skywarn station (see photo above) includes a computer, which can display weather reports, maps and webcams, a 2-meter VHF radio for packet (a type of text communications), a 2-meter/70 centimeter VHF/UHF radio for voice contacts and the HF radio.

For additional information or if you are interested in being a part of the Skywarn radio group, please contact James Brotherton at the Hanford NWS or Bruce Buhler, KD6DRU, at 559-582-2925 or email buhler50@hotmail.com.

Sincerely,

Bruce Buhler, KD6DRU



New Faces in the Office

By Steve Mendenhall, Meteorologist-in-Charge

Two new employees joined the forecast office team last May. Brian Ochs is a meteorologist intern who transferred from the NWS office in Williston, North Dakota. Brian is a San Diego native and grew up near Los Angeles. Brian completed both his bachelor's degree in meteorology and masters degree in climatology at Arizona State University in the Department of Geography. His current interests include historical climate, long-term forecasting, and winter weather.



Marc Ganey is our newest electronics technician. He is a native of Porterville and grew up in Visalia. Marc served six years in the United States Navy as a Fire Control Technician. Marc then operated his own information technology business in Visalia, until he was hired as an electronics technician for the National Weather Service office in Hanford.



Welcome to NWS Hanford, Brian and Marc!

Simplified Winter Weather Headlines

The NWS has a lot of different headlines for various winter weather events. Beginning with this winter storm season, we will be simplifying the headlines with the main outcome being an easier to understand storm classification from office to office. These changes will also be a significant improvement to website displays and should make it easier for our media partners to display winter weather messages. Here is a comparison of what a product used to be called, and what it will be called starting this winter:

Current Product:

Blizzard Warning
Ice Storm Warning
Wind Chill Warning
Heavy Snow Warning
Winter Storm Warning
Sleet Warning
Freezing Rain Advisory
Wind Chill Advisory
Winter Weather Advisory
Snow Advisory
Snow and Blowing Snow Advisory
Sleet Advisory
Blowing Snow Advisory

Product starting this winter:

Blizzard Warning
Ice Storm Warning
Wind Chill Warning
Winter Storm Warning
Winter Storm Warning
Winter Storm Warning
Freezing Rain Advisory
Wind Chill Advisory
Winter Weather Advisory

Working Together to Save Lives and Property

National Weather Service's 2nd Annual California Hazardous Weather Awareness Week

...Hazardous Weather Awareness Week in California...

The week of September 22nd through 27th has been designated Hazardous Weather Awareness Week for the State of California. This is an excellent time for all individuals, families, businesses, schools, radio and television stations to review their hazardous weather preparedness plans. It is especially important for all new arrivals to the state to become familiar with the National Weather Service Watch and Warning definitions as well as weather safety procedures.

During the Hazardous Weather Awareness Week, the National Weather Service across California will issue Public Information Statements, broadcast messages over NOAA Weather Radio and maintain a web-site at:

<http://www.weather.gov/sanfrancisco/awarenessweek.php>

Each day we will highlight particular weather hazards and/or dissemination information:

Monday:	Severe Weather
Tuesday:	Floods
Wednesday:	Wildfires
Thursday:	Excessive Heat
Friday:	Coastal and Winter Storms
Saturday:	NOAA Weather Radio

Stay abreast of the latest weather information by checking weather.gov often and clicking on your area of interest.

Attention Motorists!

Need to know the latest road reports when you are traveling?
CalTrans has set up a special number you can call to find out the status of roads.

Dial 1-800-427-ROAD.

Flash Flooding in Kern County

By James Brotherton, WCM

On July 11 and 12, southerly winds brought a large scale monsoon pattern to southeast California, resulting in increased moisture and instability parameters that are conducive to slow moving, heavy-rainfall producing thunderstorms. During the afternoon of July 12, a large cluster of slow moving thunderstorms developed across southeast California, especially in the Mojave Desert and Owens Valley and near the Southern Sierra Nevada.

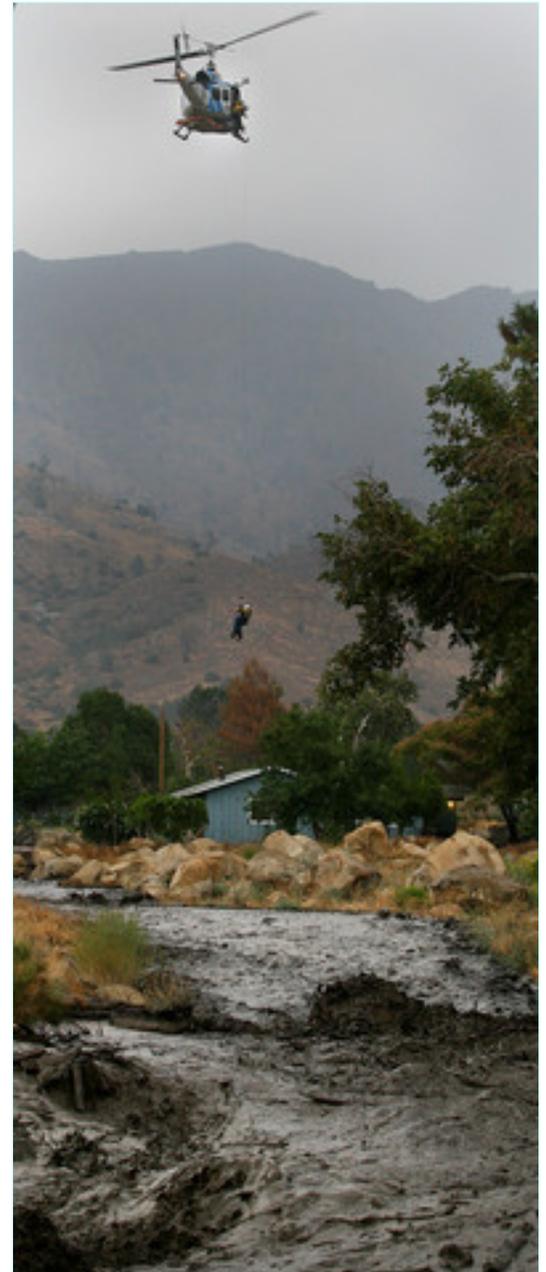
Especially heavy rainfall occurred over a short time in the Lake Isabella area of Kern County over terrain that had recently been scarred by the Piute Fire Complex. Fast moving flash flood waters were a result, causing considerable damage to roads, businesses, and homes, and necessitating several water rescues.

Similarly, according to reports from the National Weather Service office Las Vegas, NV, especially heavy rainfall also occurred over a short time in nearby Inyo County near the town of Independence. A few thunderstorms developed on top of the Inyo Fire Complex (from last summer) causing flash flooding to the north of the Independence area. Rains across the burn area caused mud and debris to wash into the Oak Creek and West Fort Independence areas.

It should be noted that scattered thunderstorms occurred across much of southeast California and southwest Nevada during the afternoon and evening of July 12 (as well as for several continuous days thereafter). The particular thunderstorms that caused the flash flooding mentioned above occurred over very sensitive areas due to the effects of wildfires. This includes a lack of topsoil and vegetation capable of water absorption and fire debris that are easily swept in fast-moving runoff.

Luckily, no reports of fatalities or serious injuries were received. However there were several swift water rescues as a result of motorists driving into standing and/or fast-moving flood waters. Everyone is reminded to heed the advice of the National Weather Service:

Turn Around, Don't Drown!



...article continues on next page...

Below are a few additional images received of flash flood waters and debris flow from flash flooding near the Piute Complex and Lake Isabella. All images shown above and below are courtesy of Joe Solomon and Mark Stubblefield, NWS Incident Meteorologists, David Johnson of High Desert News, and the Kern County Fire Department. Thank you to all who submitted photos of the flash floods during early July in Kern County.



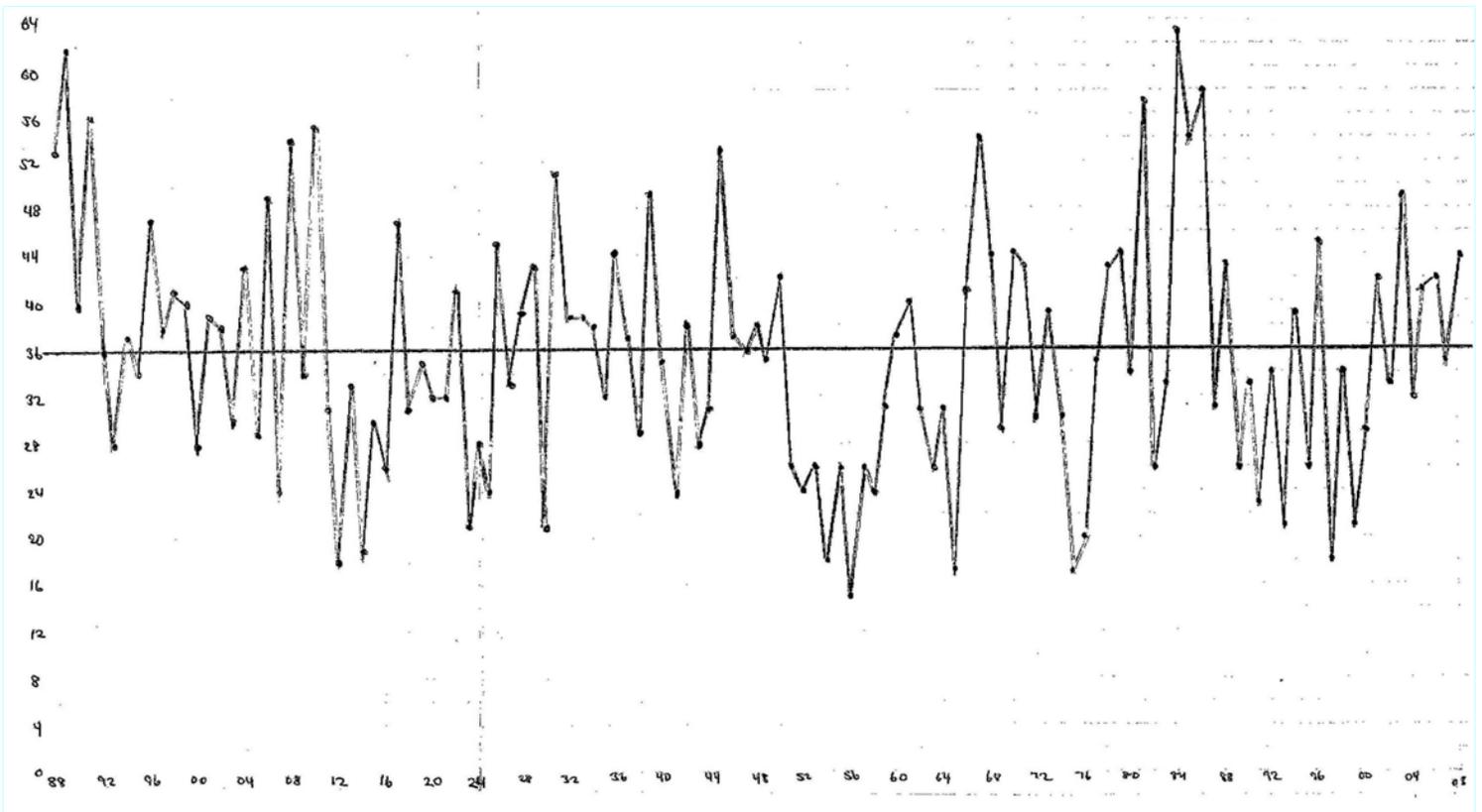
Fresno 100-Degree Days by Year

By Gary Sanger, Senior Meteorologist and Climate Services Focal Point

The graph below shows the number of 100-degree days per year for Fresno, California, from 1888 (the first year with a complete temperature record) through September 12, 2008.

The greatest number of 100-degree days occurred in 1984 (63 days); the least in 1956 (15 days). The average number of 100-degree days per year is 36 days. So far this year, there have been 44 100-degree days this year as of September 12.

Fresno 100-degree Days by Year, 1888-2008



Weather Words

By Kevin Durfee, Meteorologist

S O A R E Y A L I S L E C R Y N N U S F I N D I
 T L V A S H G D B O W E D O O L F M H A Z O M R
 R H I B G U M S U I L E C H A L O E H H A U O O
 A U R A S M I W M S S L A Y A K V T Y P H O O N
 T M G R E V E S I F O I H G G A I E H A Z B D I
 R I B O W E C U L N A A V R P O S O Z O N U O T
 S P O M I B R O F E D H I O H M L R Z E S P H A
 M E T E N A O E R Y C S R M O S M O K T O D C R
 E M V T D R A F T P G A G E O O N L R A N R E O
 T R M E M O F I Y E T N A T N R G O R O L A W P
 E O U R R M L L P I M O R G Y H U G O M E F O A
 O T H U M I D W O O L O R O E T E M U Z E T B V
 R S A U B T E N O O H E R E V E S I A S O A E E
 O D F I L A G A N E O R O G R A P H T O T N A M
 L N S N T R A T U E K O M S Y D N I W O B R E O
 O I I H Y G R O M E T E P C I H P A R G O R O
 V W E A T H E R S U T A R T S T R A T U W S U D

<i>ash</i>	<i>flood</i>	<i>hygrometer</i>	<i>storm</i>
<i>barometer</i>	<i>gage</i>	<i>layer</i>	<i>stratus</i>
<i>bow echo</i>	<i>gust</i>	<i>meteorology</i>	<i>sunny</i>
<i>celsius</i>	<i>hail</i>	<i>moon</i>	<i>typhoon</i>
<i>dust</i>	<i>halo</i>	<i>orographic</i>	<i>updraft</i>
<i>evaporation</i>	<i>haze</i>	<i>ozone</i>	<i>virga</i>
<i>fahrenheit</i>	<i>hot</i>	<i>severe</i>	<i>visibility</i>
<i>flag</i>	<i>humid</i>	<i>smoke</i>	<i>weather</i>
	<i>windy</i>		

See Solution on Page 25

Runnin' the Numbers		Fresno				Bakersfield			
		March 2008	April 2008	May 2008	June 2008	March 2008	April 2008	May 2008	June 2008
TEMPERATURE (°F)	Average Maximum	69.0	75.4	83.7	95.1	70.1	75.6	82.8	93.7
	Average Monthly	57.0	61.7	70.3	79.1	58.0	62.3	70.7	79.7
	Departure from Normal	1.8	0.5	1.5	3.0	0.7	-0.4	0.4	2.0
	Average Minimum	44.9	48.0	56.9	63.1	45.8	48.9	58.6	65.6
	Maximum	79	94	103	110	81	94	103	110
	Date(s)	23 rd , 24 th	13 th	18 th , 19 th	21 st	10 th	13 th , 27 th	16 th	21 st
	Minimum	35	41	45	54	39	38	48	56
	Date(s)	16 th	9 th , 20 th , 22 nd	1 st	2 nd	3 rd	21 st	1 st	7 th
	Number of Days Max ≥90	0	4	7	22	0	4	7	22
	Number of Days Max ≥100	0	0	4	8	0	0	2	4
Number of days Min #32		0	0	0	0	0	0	0	0
PRECIPITATION (in.)	Total	0.02	Trace	0.30	0	Trace	Trace	0.08	0
	Departure from Normal	-2.18	-0.76	-0.09	-0.23	-1.41	-0.45	-0.16	-0.12
	Greatest in 24 hrs	0.01	Trace	0.17	--	Trace	Trace	0.08	--
	Date(s)	13 th , 15 th	22 nd , 23 rd	25 th -26 th	--	15 th	2 nd	23 rd	--
	Number days w/precip.	2	2	5	0	1	1	3	0
	Seasonal Total	8.10	8.10	8.40	8.40	2.30	2.30	2.38	2.38
	Departure from Normal	-1.75	-2.51	-2.60	-2.83	-3.38	-3.83	-3.99	-4.11
Compared to Normal		82.2	76.3	76.4	74.8	40.5	37.5	37.4	36.7
WIND (mph)	Peak Speed	36	39	39	40	35	32	40	35
	Direction	NW	NW	NW	NW	W	NW	N	NW
	Date(s)	26 th	14 th	21 st	10 th	15 th	14 th	20 th	4 th
PRESSURE (in.)	Highest	30.37	30.25	30.07	M	30.37	30.26	30.09	M
	Date	21 st	24 th	29 th	M	21 st	24 th	29 th	M
	Lowest	29.86	29.76	29.35	29.72	29.83	29.76	29.41	29.72
	Date	16 th	18 th	22 nd	4 th	29 th	19 th	23 rd	4 th

Chartin' the Changes

By Gary Sanger, Senior Meteorologist & Climate Services Focal Point

MARCH 2008 WEATHER SUMMARY

High pressure aloft was over the southern half of California at the beginning of March, behind the storm complex exiting the state. Despite abundant ground moisture and a stable airmass, fog remained limited to a few patches across the central and southern San Joaquin Valley; the patchy fog formed shortly before sunrise and mostly burned off between 8 AM and 9 AM.

An upper-level trough moved through northern California during the afternoon of March 1st, riding over, and weakening, the upper-level ridge over the southern part of the state. The trough was mostly dry, but it did tighten surface pressure gradients across southern California. West to northwest winds gusted to 50-55 mph over the Kern County deserts and mountains during the afternoon and evening of the 1st.

Unseasonably cold air accompanied the trough, plunging temperatures to below-normal readings. Fresno dropped from a record-tying high of 76 on February 29th to a high of only 62 on March 1st, and again on the 2nd. Bakersfield likewise saw a 14-degree drop, from a high of 77 on Leap Year Day to a high of only 63 on March 1st (and again on the 2nd).

The central California interior has relatively tranquil weather beginning March 3rd, as weak high pressure aloft moved over California behind the trough. Fresno warmed to 70 on March 7th, and to 77 on the 10th, the warmest day of the month at Fresno-Yosemite International Airport. Bakersfield reached a high of 81 degrees on March 10th, the first 80-degree day at Meadows Field since November 7th, 2007.

A weak upper-level trough moved through California on March 13th, bringing gusty winds to the mountains and deserts, but only spotty light precipitation to the region. Numerous gusts of 45-60 mph were reported in the Kern County mountains and deserts on the 13th and 14th.

The trough was followed by a stronger system on the 15th, which brought colder air to the region. Gusty winds—to around 50mph—continued over the mountains and deserts, and gusts even developed over parts of the San Joaquin Valley (where gusts to 37 mph were reported). The main impact of the trough was precipitation, as measurable snow fell as low as 3500 feet on the Grapevine, and thunderstorms developed over the west side of the San Joaquin Valley during the afternoon of the 15th. One thunderstorm, near Mendota, reached severe levels and produced $\frac{3}{4}$ -inch hail and damaging winds. Other thunderstorms generated hail that ranged from pea-size to $\frac{1}{2}$ -inch in diameter. These storms extended south along the Interstate 5 corridor to near Taft, and as far east as Visalia and Arvin (where the $\frac{1}{2}$ -inch hail fell and knocked out power to part of the town when a transformer insulator hub was shattered). A thunderstorm near Maricopa during the late afternoon approached severe criteria, prompting the second Severe Thunderstorm Warning of the day, but the storm weakened before becoming severe.

Up to 4 inches of snow fell on the Frazier Park area, with 4-6 inches falling above 6500 feet in the western Tehachapi Mountains. In the Southern Sierra Nevada, snow amounts ranged from 5 inches at Ponderosa to one-inch accumulations at Lodgepole and Tuolumne Meadows. Other snow reports included 1.5 inches at Bear Valley Springs and Hume Lake, and 2 inches at Grant Grove.

A cold, dry airmass moved into the central California interior with the trough. A few Valley sites reached freezing the morning of the 16th, and again on the 17th, but the frost was not widespread.

Another upper-level trough moved into California on March 19th. Except for a couple of isolated showers over the high Sierra, moisture remained north of the central California interior. A ridge of high pressure aloft moved into California behind this trough, and temperatures warmed to several degrees above normal.

Fresno approached, but did not reach, the 80-degree mark under the upper-level ridge. The high at Fresno-Yosemite International Airport reached 79 degrees on both March 23rd and 24th, while Bakersfield had its second 80 degree day of the month on the 23rd. Fresno's 79-degree highs were the warmest days of the month for the city.

An upper-level trough moved into northern California on March 25th. This trough brought isolated showers to Yosemite National Park during the late afternoon of the 25th, but this was the only precipitation from the system. The trough did bring gusty west to northwest winds to the Kern County mountains and deserts, and the higher-elevations of the Southern Sierra Nevada.

A stronger, and wetter, system moved into California on March 28th, bringing interior central California gusty winds and precipitation that persisted through the 30th. In the central and southern San Joaquin Valley, only a few showers developed, with the heaviest rainfall—0.09 inch at Lemon Cove during the early morning of the 30th—near the Sierra foothills. Winds gusted as high as 38 mph on the Valley floor on the 28th, while gusts to around 50 mph continued over the mountains and deserts through March 30th. The storm brought a push of cold air to the region, with snow levels dropping to around 5000 feet by the morning of the 30th, and locally even lower as Tehachapi recorded a trace of new snow. Appreciable snow fell in the Southern Sierra Nevada during the morning of March 30th as the upper-level trough axis moved through the region, with Tuolumne Meadows in Yosemite National Park reporting 4 inches of new snow, and further south, Lodgepole had 5.5 inches and Grant Grove getting 4.7 inches of snow.

The storm moved east of the region on March 31st, for a dry end to the month. Bakersfield ended March with no measurable rain and its total of a trace tied with March 1956 for its second driest March on record; only March 1934, with no rain, was drier. Fresno's 0.02 inch of rain for March gave the city its fifth driest March on record, with only March 1972 (no rain), 1934 (a trace), and 1926 and 1966 (0.01 inch) drier.

APRIL 2008 WEATHER SUMMARY

The storm that moved east of the region on March 31st was followed by another in early April. This storm dropped along the California coast, rather than moving inland over central California. As a result, light rain fell in Bakersfield north to Hanford, and on the Tehachapi Mountains, but (except for 0.01 inch of rain at Los Banos, and a trace of snow at Tuolumne Meadows) the central San Joaquin Valley from Fresno north and the Southern Sierra Nevada remained dry. One strong shower did develop in the Tehachapi Mountains near Bear Valley Springs the night of April 2nd, dropping 1.54 inch of rain; elsewhere, rainfall reports were a quarter inch or less.

The trace of rain that fell at Meadows Field on April 2nd was the only precipitation recorded for Bakersfield during the month, and marked the second consecutive month that no measurable rain fell at Meadows Field. By April 30th, Bakersfield had gone 66 days without measurable rain.

Temperatures in the central and southern San Joaquin Valley warmed into the mid to upper 70s on April 4th as weak high pressure moved over California, then plunged as much as 9 degrees the next day as a mostly dry upper-level trough moved into the state. The trough remained over the state through the 9th, with gusty winds developing over the Kern County mountains and deserts during the night of April 8th-9th, as the upper-level jet on the back side of the trough moved through the region. Winds gusted to around 60 mph over the mountains, and to 65 mph at the base of the Tehachapi Pass near Mojave. Precipitation over the high country of the Southern Sierra Nevada also was reported on the night of the 8th-9th, ranging from an inch of new snow at Tuolumne Meadows to a trace at Lodgepole. This was the only precipitation reported from this system.

A stronger upper-level ridge moved into California beginning April 10th, bringing the warmest temperatures of the month to most of the central and southern San Joaquin Valley. Bakersfield warmed from a high of 66 degrees on April 9th to a record-tying high of 94 degrees on the 13th (last set in 1985). Fresno went from a high of 69 on April 9th to a high of 94 on the 13th. Fresno had its first 80-degree day of 2008 on April 11th (with a high of 83), followed by the first 90-degree day of the year at both Bakersfield and Fresno the next day when both cities had highs of 90 degrees.

Another dry upper-level trough moved into California on April 14th, dropping central and southern San Joaquin Valley high temperatures as much as 18 degrees, from the lower to mid 90s on the 13th to only the mid 70s to mid 80s the next day. The trough also brought another round of gusty winds to the Kern County mountains and deserts, with gusts in the 45-55 mph range reported on the 15th.

Central and southern San Joaquin Valley high temperatures were only in the mid to upper 60s on April 15th, then warmed back into the 80s by the 17th and 18th, as another upper-level ridge moved into California. Again, the warming was short-lived, as an upper-level trough moved into the state on the 19th, and plunged high temperatures to their coldest values of the month on the 20th. This cold airmass brought isolated freezing to sub-freezing temperatures to the east side of the San Joaquin Valley on the morning of April 21st, with one report of a low of 27 degrees near the Sierra foothills.

In contrast to the trough at the beginning of April, this trough brought precipitation to the northern half of the WFO Hanford's warning/forecast area. Tuolumne Meadows received 3 inches of new snow on April 22nd, while light rain spread as far south as Hanford and Lemon Cove. Although the ASOS at Fresno-Yosemite International Airport recorded only a trace of rain from the storm on the 22nd-23rd, the Fresno Air National Guard's rain gauge had 0.02 inch, evidence of the spotty nature of the precipitation.

Winds in the Kern County Mountains and deserts gusted to 45-55 mph on April 19th-20th, as the surface cold front moved through the area, but upper-level support for gusty winds was limited and the winds diminished during the day on the 20th.

Weak high pressure returned to California on April 25th, as temperatures climbed to near normal, and continued to warm on the 26th, when Valley temperatures were in the 80s. Temperatures continued to climb on the 27th, with central and southern San Joaquin Valley highs in the lower to mid 90s. Bakersfield warmed to 94 degrees, tying its warmest day of the month (and year to date); Fresno was only a degree cooler. Temperatures were slightly cooler the next day, but highs in the central and southern San Joaquin Valley on the 28th, as well as most of the Kern County deserts (except Mojave) remained in the 90-93-degree range.

A dry cold front moved into California on April 29th, plunging San Joaquin Valley high temperatures as much as 17 degrees from the previous day. Bakersfield's high of 79 degrees, while 14 degrees cooler than the 93 on the 28th, matched the normal high temperature at Meadows Field for the day.

Gusty winds accompanied the cold front as it moved through California. Gusts to 60 mph were reported in the Kern County mountains and deserts, and a few gusts between 35-40 mph occurred in the central and southern San Joaquin Valley. High temperatures in the central and south Valley continued to cool, falling several degrees below normal on the last day of April with readings in the upper 60s to mid 70s

April was an exceptionally dry month for the central and southern San Joaquin Valley, with neither Bakersfield nor Fresno reporting measurable rain. For Bakersfield, it has been an extremely dry rain season so far, the third driest July-April in 119 years of records. As April historically marks the end of the wettest months of the rain season, Bakersfield could end with this season as one of the five driest on record; if no more measurable rain were to fall, only the 1933-34 rain season would be drier. April rain statistics for Bakersfield and Fresno are found on the next page.

The Driest April's on Record

BAKERSFIELD	FRESNO
1. 1966...0.00 INCH	1. 1898...0.00 INCH
1934...0.00 INCH	2. *2008...TRACE *
1910...0.00 INCH	1997...TRACE
1909...0.00 INCH	1934...TRACE
1894...0.00 INCH	1918...TRACE
1890...0.00 INCH	1909...TRACE
2. *2008...TRACE *	3. 1949...0.01 INCH
1997...TRACE	4. 1991...0.02 INCH
1993...TRACE	1962...0.02 INCH
1992...TRACE	1916...0.02 INCH
1989...TRACE	5. 2004...0.03 INCH
1985...TRACE	1946...0.03 INCH
1979...TRACE	6. 1977...0.04 INCH
1977...TRACE	7. 1989...0.05 INCH
1913...TRACE	8. 1919...0.06 INCH
1902...TRACE	9. 1987...0.07 INCH
1892...TRACE	1979...0.07 INCH
3. 1933...0.01 INCH	10. 1922...0.10 INCH

The Driest March-April Aggregates on Record

BAKERSFIELD	FRESNO
1. 1934...0.00 INCH	1. 1934...TRACE
2. *2008...TRACE *	2. *2008...0.02 INCH *
3. 1992...0.08 INCH	3. 1997...0.10 INCH
4. 1933...0.18 INCH	4. 1966...0.16 INCH
5. 1997...0.21 INCH	5. 1972...0.27 INCH

NORMAL.....1.86 INCH NORMAL.....2.96 INCHES

Although Fresno has had numerous dry seasons to date, the July 2007-april 2008 rain season is the third driest since Records began for Bakersfield. The five driest seasons to date for Bakersfield are:

1. JULY 1971-APRIL 1972	1.87 INCH	TOTAL...3.00 INCHES
2. JULY 1933-APRIL 1934	1.96 INCH	TOTAL...2.21 INCHES
3. JULY 2007-APRIL 2008	2.31 INCHES	TOTAL...
4. JULY 1958-APRIL 1959	2.42 INCHES	TOTAL...2.45 INCHES
5. JULY 1892-APRIL 1893	2.58 INCHES	TOTAL...2.77 INCHES

MAY 2008 WEATHER SUMMARY

A dry cold front moved into California on April 29th, plunging San Joaquin Valley high temperatures as much as 17 degrees from the previous day. Bakersfield's high of 79 degrees, while 14 degrees cooler than the 93 on the 28th, matched the normal high temperature at Meadows Field for the day. These cold temperatures continued into May 1st, for a cool start for the month.

Weak high pressure warmed the region beginning May 2nd, then another dry cold front moved into central California on the 7th. Ahead of this front, temperatures warmed several degrees, with Fresno warming from 81 on May 5th to 88 on the 6th, then cooling to only 79 on the 7th. This pattern was repeated as weak high pressure again moved into the state. By May 11th, the high temperature at Bakersfield had warmed to 87 degrees, only to fall 10 degrees the next day as yet another dry system moved through.

The middle of May saw a significant pattern change as strong high pressure aloft moved over California, and remained in place for several days. By the 14th, temperatures across the region had warmed back above normal, and 90s were widespread in the central and southern San Joaquin Valley the next day with Coalinga and Delano reporting the first 100-degree readings of the year. Triple-digit temperatures were common in the Valley on the 16th and 17th, and both high temperature and high minimum temperature records fell at Fresno through May 19th; Bakersfield also set high minimum temperature records on the 16th and 17th.

A low-pressure system moving into the Pacific Northwest weakened the high pressure over California, allowing a stronger system to bring cold and windy conditions to the state. Temperatures in the central and southern San Joaquin Valley dropped from the 90s on May 20th to the mid 70s to lower 80s on the 21st and 22nd. Winds gusted to 45 mph in parts of the San Joaquin Valley both days, with gusts of 65-70 mph in the Kern County mountains and deserts.

The cold, unstable airmass that settled into central California on May 22nd brought showers to the Southern Sierra Nevada and Tehachapi Mountains, with measurable snow falling below 5000 feet in the Tehachapis, and down to 6500 feet in the Southern Sierra Nevada. During the morning of the 23rd, showers drifted north from the Tehachapi Mountains into the south end of the San Joaquin Valley. By midday, these showers had moved as far north as Bakersfield, where a record-breaking 0.08 inch of rain fell at Meadows Field. This was the first measurable rain to fall in Bakersfield since February 24th, ending an 87-day period without measurable rain. The next day, Fresno recorded its first measurable rain since March 15, ending a 69-day period with no measurable rain. The storm brought the only measurable rains for the month to Bakersfield (storm total: 0.08 inch) and Fresno (0.30 inch). The rain did keep Bakersfield from solely having the driest March-May period on record; the 0.08 inch for the period tied March-May 1992 for the driest "spring."

The cold airmass brought near-record low maximum temperatures to the central and southern San Joaquin Valley on May 25th. Bakersfield did set a record low maximum with a high of only 58 degrees; the old record was 67 degrees, set in 1917. At Fresno, the high was slightly warmer at 61 degrees. This was 2 degrees warmer than the record low maximum temperature for May 25th of 59 degrees, set in 1906.

Temperatures slowly recovered through the end of the month, but remained below normal. The last day of the month saw another upper-level trough approach the California coast. The coastal marine layer deepened to over 3500 feet in response to the approaching trough, and marine air spilled through the Pacheco Pass into the San Joaquin Valley near Los Banos. Gusty winds developed over the San Luis Reservoir, with sustained wind speeds of 23-26 mph, and gusts to 36 mph. This prompted the issuance of a Lake Wind Advisory due to the danger to boaters from swells and chop.

JUNE 2008 WEATHER SUMMARY

June saw the fourth consecutive month of below-normal rainfall in the central California interior, as neither Fresno nor Bakersfield had any rain. While dry Junes are not uncommon (this was Bakersfield's 72nd dry June, and Fresno's 50th), the prospect of a dry June coming on the heels of the driest March-May on record for Bakersfield, and the 4th driest for Fresno, was a factor in Governor Schwarzenegger declaring a drought for the state on June 4th. In addition to the agricultural and hydrological impacts of the dry weather, the fire danger due to dried brush and other vegetation was high, and thunderstorms that moved through the state during the latter half of the month triggered numerous wildfires.

Bakersfield ended the 2007-2008 rain season (which runs from July 1st to June 30th) with a season total of only 2.38 inches, or 36.7 % of the normal of 6.49 inches. The past season was the 2nd driest on record, surpassed only by the 1933-34 season which saw only 2.21 inches. Fresno fared much better, due to an unseasonably wet December through February, but the rains ended abruptly in late February and the season ended with 8.40 inches. This was 74.8 % of Fresno's normal of 11.23 inches.

June began with temperatures only slightly below normal for the first three days of the month. The first in a series of upper-level troughs of low pressure moved into California on the first day of the month. Along the coast, the marine layer deepened, reaching a depth in excess of 3500 feet. As cold marine air spilled through the Sacramento delta and the Pacheco Pass, high temperatures in the central and southern San Joaquin Valley got no warmer than the mid 80s, where they would remain the next two days.

The second trough reached the central California interior on the 3rd-4th. The dry cold front associated with the trough brought gusty winds to the Kern County deserts on June 3rd, and several degrees cooling to the entire region on the 4th. Winds gusted 45-50 mph in the Indian Wells Valley, and to nearly 70 mph at Mojave. In the San Joaquin Valley, winds gusted to 35 mph at Meadows Field, Bakersfield, with similar readings across the Valley floor. This trough was stronger than its predecessor, and the push of cold air that moved into the region dropped high temperatures from the mid 80s on the 3rd to the upper 70s to around 80 the next day.

Temperatures returned to near normal over the next few days. A weak system brought gusty winds to the west side of the San Joaquin Valley on June 7th, with a few gusts reaching 35 mph. Another cold front moved through central California on June 10th. Winds gusted to 40 mph at Fresno-Yosemite International Airport and the Merced Municipal Airport, and gusts to around 45 mph were reported in the Kern County mountains and deserts. Temperatures dropped as much as 7 degrees in the cold air behind the front, but as with the earlier system, the cooling was short-lived.

High pressure built into California during the middle of the month, pushing temperatures several degrees above normal. Fresno had a high of 103 degrees on June 13th, for its first triple-digit temperature since May 19th. Bakersfield only hit 99 on the 13th, but had a high of 101 the next day, for the first triple-digit reading at Meadows Field since May 17th. Temperatures remained above normal for the next several days, culminating in record highs of 110 degrees at both Bakersfield and Fresno on June 21st.

By June 19th, the central California interior was under an upper-level ridge centered over the Desert Southwest, held in place by a blocking trough over eastern North America. In the Pacific Northwest, an upper-level low was forming west of the Queen Charlotte Islands (the chain of islands extending from north of Vancouver Island toward the Alaskan Panhandle). An upper-level trough developing from the low would prove to have a major impact on California's weather the next few days.

The upper-level ridge moved inland on June 20th as the upper-level trough deepened over the east Pacific. A disturbance moving up the leading edge of the trough triggered thunderstorms west of the central California coast during the morning of the 20th. In the warm, unstable airmass, thunderstorms developed near the Southern Sierra Nevada crest, but moved north and east of the Sierra, spreading into Inyo and Mono Counties.

The strong warming on the 21st increased the instability of the airmass over the region, triggering another round of thunderstorms that moved across northern and central California during the day and into the night of the 21st-22nd. Lightning strikes from these mostly dry thunderstorms triggered numerous wildfires across the state. A few showers and thunderstorms did produce measurable rain, including one storm that dropped a tenth of an inch of rain on Giant Forest. One shower that developed over the central San Joaquin Valley moved over the northern part of the city of Fresno, but stayed north of Fresno-Yosemite International Airport. As a result, Fresno's record of a dry June 21st—the only day with zero precipitation—remained intact for the 131st year of records. Scattered showers developed over the central San Joaquin Valley in Merced and Madera Counties. A rain gage near Los Banos measured 0.02 inch, the only measurable rain in the central Valley; none of the ASOS's in the central Valley—Fresno, Madera or Merced—reported any precipitation from these showers.

The trough that triggered the thunderstorms on the 20th and 21st moved through California on the 22nd, allowing an upper-level ridge to build into the region. The ridge strengthened the inversion over the central California interior, and smoke from the wildfires in the Sierra Nevada and along the coast was trapped in the region

On June 25th, another upper-level trough developed in the east Pacific. Over California, the upper-level ridge continued to keep the strong inversion in place, and air quality deteriorated. The smoke did reduce the amount of solar heating across the central California interior. Temperatures did not warm as much as would have been expected in clear air, and although a few showers developed over the Southern Sierra Nevada, no lightning was observed.

The trough brought some cooling to the region, with temperatures falling back to near normal, and also allowed the marine layer along the coast to deepen to 2400 feet during the late evening of the 25th, with marine air spilling through the Pacheco Pass and triggering gusts to 38 mph over the San

Luis Reservoir. The closed upper-level low formed in the base of the trough, west of Point Conception, on June 26th. North of the low, a west-east oriented ridge of high pressure pushed into Oregon and northern California. A well-defined boundary developed along the southern edge of the ridge, triggering thunderstorms that moved west over the Sierra Nevada and the northern San

Joaquin Valley in the flow around the ridge. This was the last thunderstorm activity over the Southern Sierra Nevada, as the circulation around the closed off-shore low combined with the flow around the upper level ridge over the Desert Southwest to produce a south to southwest flow aloft over the central California interior the last few days of the month. This flow pushed any developing thunderstorms north and east of the Southern Sierra Nevada crest.

Smoke from the wildfires in the Southern Sierra Nevada and near the coast settled over the San Joaquin Valley, resulting in degraded air quality and the issuance of an Air Stagnation Advisory by the San Joaquin Valley Air Pollution Control District. The smoke had little impact on temperatures, which warmed to slightly above normal on June 27th with little change through the end of the month.

Listed below are rainfall totals for selected cities in the central and southern San Joaquin Valley. Please note that the rainfall totals for Hanford, Merced and Visalia were recorded at the official Climatological stations for those cities, and may differ from airport readings.

CITY	2007-08 RAINFALL IN INCHES	NORMAL RAINFALL IN INCHES	DEPARTURE FM NORMAL IN INCHES	PERCENT OF NORMAL
COALINGA	7.20	8.30	-1.10	86.7
MERCED	10.06	12.50	-2.44	80.5
LINDSAY	9.85	12.57	-2.72	78.4
FRESNO	8.40	11.23	-2.83	74.8
LOS BANOS	7.02	9.95	-2.93	70.6
HANFORD	5.75	8.58	-2.83	67.0
VISALIA	6.66	11.03	-4.37	60.4
DELANO	4.14	7.55	-3.41	54.8
BAKERSFIELD	2.38	6.49	-4.11	36.7

JULY 2008 WEATHER SUMMARY

There was little change in the weather pattern over the central California interior for the first three days of July, as an upper-level ridge of high pressure centered over Arizona kept central and southern San Joaquin Valley high temperatures in the mid to upper 90s. By the 3rd, an upper-level low approached the Oregon coast. A trough associated with the low moved through the state on Independence Day, bringing as much as 8 degrees cooling to the central California interior and dropping central/south Valley highs into the mid 80s to around 90. The airports at Madera and Merced both reported highs for July 4th of only 86 degrees, and neither Bakersfield nor Fresno got warmer than 90.

The trough moved northeast of the region on July 5th as the upper-level ridge over Arizona built back over California, and another ridge over the east Pacific spread eastward. The two ridges merged, pushing the jet stream north of the state and bringing a strong warming trend. The numerical forecast models had indicated this warming trend several days in advance, and the National Weather Service Forecast Office in Hanford began issuing Special Weather Statements in the afternoon of July 4th on the upcoming unseasonably hot weather.

As the ridge strengthened, temperatures warmed several degrees daily. A Heat Advisory was issued during the afternoon of July 8th for temperatures in the central and southern San Joaquin Valley expected to be above 105 degrees over the next few days.

The center of the ridge moved north to over Oregon, with circulation around the ridge core setting up an east-to-west flow over the Southern Sierra Nevada. Thunderstorms developed over Mono County during the afternoon of July 7th, and drifted over the crest into Yosemite National Park. The next day, convection developed over the eastern California deserts, spreading westward into the mountains and Kern deserts. Mid-level clouds from these thunderstorms spread over the Hanford Warning/Forecast Area on the 9th, keeping overnight temperatures warm. In the mountains and deserts, the clouds reduced the solar heating. As a result, convection was limited.

Temperatures rose to 10-15 degrees above normal by July 10th. Fresno reached a high of 112 on July 10th, and Bakersfield reached 111 degrees. Low temperatures for the two cities were in the lower to mid 80s both on the 9th (although this was due more to the clouds over the region) and on the 10th, setting record high minimum temperatures both days. Compounding the impact of the increasing temperatures, smoke from Piute fire began drifting into the Kern Mountains and south end of the San Joaquin Valley on the 7th, then spread northward over the next several days.

The upper-level ridge moved inland on July 11th, with a trough moving to along the coast. This pattern set up a southerly flow aloft over California, drawing up monsoonal moisture from the southeast on the 12th. Thunderstorms formed over the Tulare County Mountains by the early afternoon of the 12th. The storms become stronger as they spread south into Kern County. A strong thunderstorm over the Piute Wildfire area dropped locally heavy rain on land denuded by the fire. This resulted in runoff filling creeks and streams, with a mud and debris flow flooding part of the town Lake Isabella.

Strong thunderstorms over the El Paso Mountains during the afternoon of July 13th caused flash flooding on the Randsburg Road, with erosion of the road. Later storms over the Piute Mountains caused flooding of Erskine Creek with mud and debris flows again moving into the town of Lake Isabella.

Afternoon and evening thunderstorms continued through the 15th, with activity diminishing on the 16th. Flooding was observed in the Thompson Canyon, Erskine Creek, and Kelso Canyon areas. The town of Lake Isabella experienced three days of mud and debris flows flooding parts of the town.

The upper-level ridge built back into California on the 17th-19th. A thunderstorm north of Ridgecrest during the afternoon of July 17th dropped ½-inch diameter hail. The next two days brought the mountains and deserts a brief respite from the thunderstorms. An upper-level trough approached California on the 20th, bringing another surge of monsoonal moisture into the eastern Kern deserts. Outflow boundaries from nocturnal convection over Arizona and northern Mexico generated pre-dawn showers over the China Lake Naval Air Warfare Center and spread clouds across the mountains and the San Joaquin Valley. With the warm, unstable airmass over the region, showers and thunderstorms developed over the Tehachapi Mountains and drifted north into Kern County around sunrise. One storm strengthened into a thunderstorm near Delano, and brought the first measurable rain to Visalia and Fresno since May 27th. 0.01 inch of rain fell at Fresno-Yosemite International Airport, and the Visalia Municipal Airport recorded 0.03 inch of rain from the storm. Widespread mid-level clouds accompanied the monsoonal moisture, and these clouds, in conjunction with a push of low-level marine air through the Sacramento Delta, brought sharp cooling to much of the central and southern San Joaquin Valley on the 20th and 21st. The high temperature for Fresno on July 19th was 102. The next day, Fresno could only reach a high of 89 degrees, a difference of 13 degrees.

One large thunderstorm formed over Barstow during the afternoon of July 20th. As the storm collapsed, strong outflow winds pushed across the Kern County deserts, triggering thunderstorms that produced flash flooding that affected much of Ridgecrest.

An upper-level ridge of high pressure built back into California beginning on July 23rd. Fresno warmed to a high of 99 that day, and was back into triple digits the following day. An upper-level trough on July 28th deepened the marine layer along the coast and brought cooling the San Joaquin Valley, with temperatures falling to near normal. Upper-level ridging returned to the central California interior on the 30th, for warmer weather. High temperatures in the warmest parts central and southern San Joaquin Valley reached the century mark on the last day of the month, although Bakersfield and Fresno stayed in the upper 90s.

AUGUST 2008 WEATHER SUMMARY

Through most of the first 10 days of August, the central California interior was between high pressure centered over the Desert Southwest and a series of upper-level troughs in the eastern Pacific Ocean and the Pacific Northwest. This pattern kept a mainly southwest flow aloft over the state, and limited mountain and desert convection by keeping the bulk of the monsoonal moisture south and east of the region. Inyokern was the only station to report any precipitation on August 4th, and that was only a trace of rain. Central and southern San Joaquin Valley temperatures during the first part of the month were near to slightly above normal, generally ranging from the mid 90s to around 100. The main exception occurred on the 8th and 9th, when a strong offshore trough deepened the marine layer to around 3000 feet along the central California coast. This allowed marine air to push through the Sacramento Delta into the northern half of the San Joaquin Valley, as well as allowing marine air to also spill through the Pacheco Pass into western Merced County.

There was a sharp temperature demarcation in the central San Joaquin Valley on August 8th, as the high at the Madera Municipal Airport only reached 94 degrees, while Fresno, only about 20 miles to the south, saw the high temperature climb to 99.

As the trough moved through the region on August 9th, the coastal marine layer continued to deepen and spill into the San Joaquin Valley. Temperatures finally fell to a degree or two below normal, but this was short-lived. The trough moved east of California by the 11th, allowing a ridge to build into California for warmer temperatures. The ridge dominated the weather pattern over California the next few days, then the ridge center moved east. This turned the flow aloft southeast and brought another surge of monsoonal moisture into California. Thunderstorms developed over the mountains of Kern and Tulare Counties on August 14th, with Tehachapi receiving a trace of rain. The focus for convection moved northward up the Southern Sierra Nevada over the next few days (with Lodgepole getting 0.01 inch of rain on the 16th—the only measurable precipitation reported in the central California interior during August) as the flow aloft gradually turned southwesterly, and by the 17th, thunderstorms were confined to mainly north of Yosemite National Park.

The mechanism for turning the flow aloft was the shifting of the ridge core westward. This also brought the warmest temperatures of the month to Bakersfield and Fresno on August 15th, when Meadows Field reached 105, and the Fresno-Yosemite International Airport was two degrees warmer. These temperatures would not be matched for two weeks.

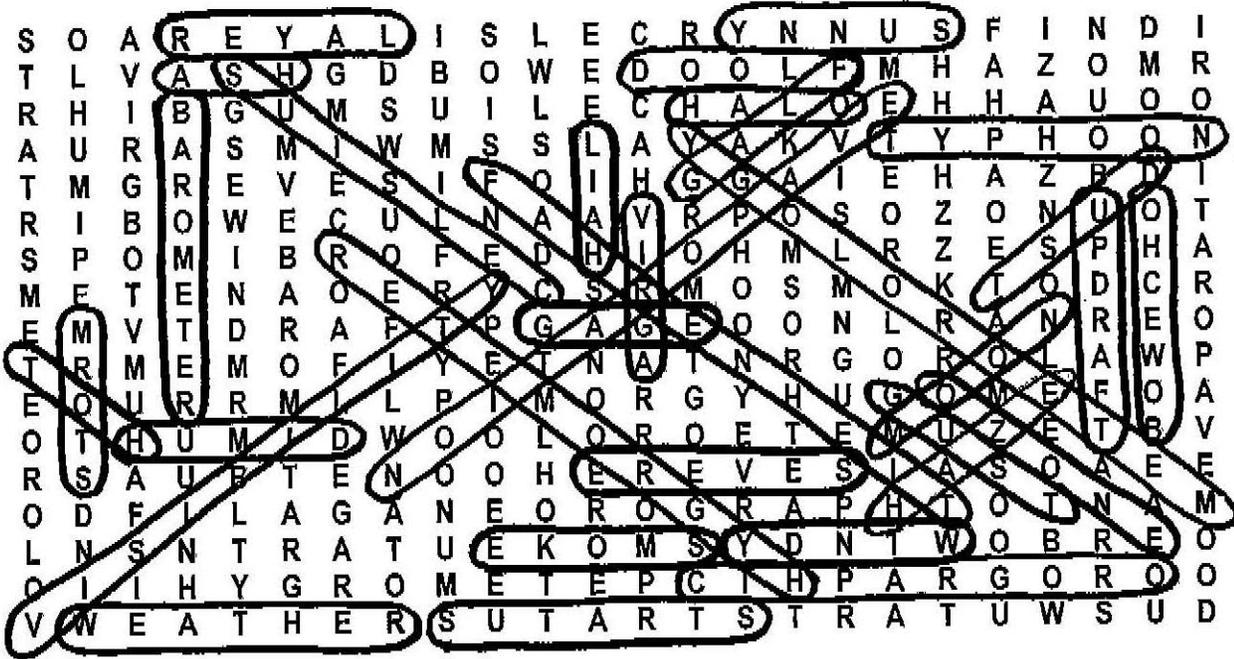
A sharp change in the weather pattern occurred on August 18th as a strong upper-level trough moved into California. Central and southern San Joaquin Valley high temperatures fell from near 100 degrees on the 17th to the mid 90s the next day, and into the mid to upper 80s on the 19th. Both Bakersfield and Fresno had a high temperature of 88 on August 19th, the only day Fresno was under 90 for the entire month of August. With marine air over the south end of the San Joaquin Valley by the surrounding mountains, Bakersfield was even cooler on the 20th, reaching a high of only 87. These were the only two days in August that Meadows Field did not have a high of at least 90.

An upper-level ridge over the Southwestern United States built back into California on the 21st, and temperatures had warmed to above normal the next day. A weak trough dropped temperatures to near normal on August 26th, but the ridge quickly rebounded. As the ridge strengthened, temperatures warmed to around 10 degrees above normal by August 29th, with the highs at Bakersfield and Fresno matching the hottest day of the month (previously, the 15th). Bakersfield matched its hottest day again on August 30th, for three days at 105. Fresno hit 107 only twice, on the 15th and 29th.

August ended with the arrival of another deep upper-level trough, which brought a sharp cool down. Bakersfield had a high of only 93 degrees on the 31st, down 12 degrees for the high of 105 the previous day. The cooling was even stronger at Fresno, which dropped from a high of 106 on the 30th to a high of only 90 the next day—a fall of 16 degrees.

Weather Words Key

By Kevin Durfee, Meteorologist



In The Clear is a newsletter issued by the:



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 Hanford, CA 93230-5236